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GB 832526
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B1C
(71) Applicant
Thomas Ronald Thomas, 13 Palace Row, Hart Village, Cleveland
(72) Inventor
Thomas Ronald Thomas
(74) Agents
Mewburn Ellis & Co., 70 & 72 Chancery Lane, London WC2A 1AD

(54) **Magnetic stirring elements**

(57) A magnetic stirring element for use in a magnetic stirrer comprises a permanent magnet (12) located within a non-magnetic body portion (10), preferably of disc-shape, one or more open-ended passageways (14, 16) being formed through the body portion (10) such that, on location of the element in a vessel containing liquid to be mixed, and on rotation of said element by an associated drive magnet outside said vessel, efficient mixing of said liquid is effected by said rotating element.

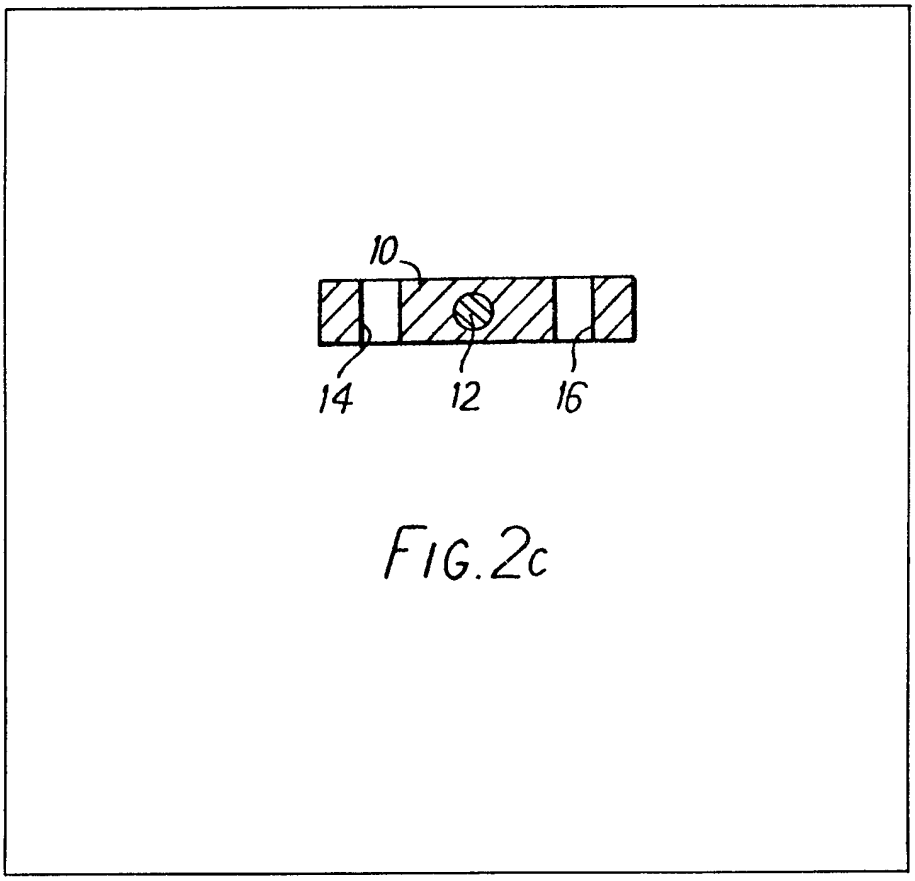

FIG. 2c

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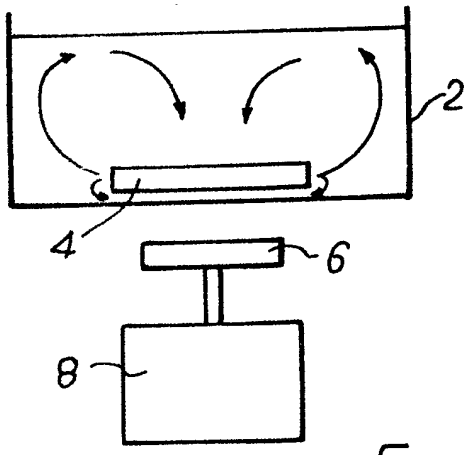


FIG. 1

FIG. 2a

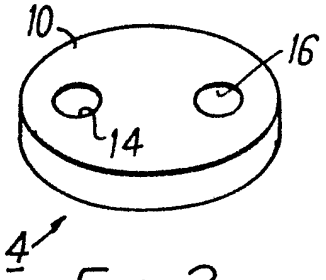


FIG. 2b

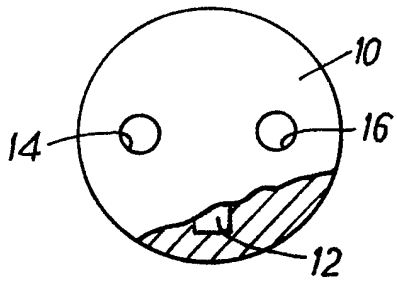


FIG. 2c

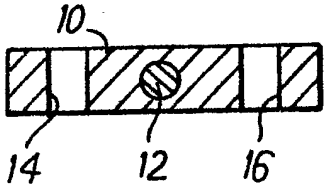


FIG. 3a

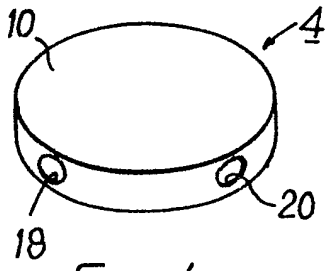


FIG. 3b

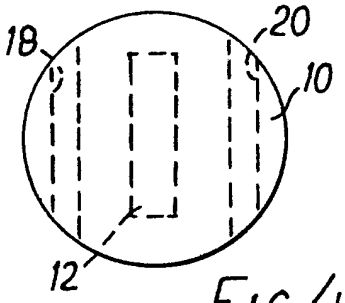


FIG. 3c

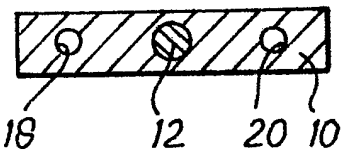


FIG. 4a

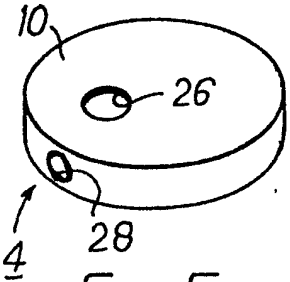


FIG. 4b

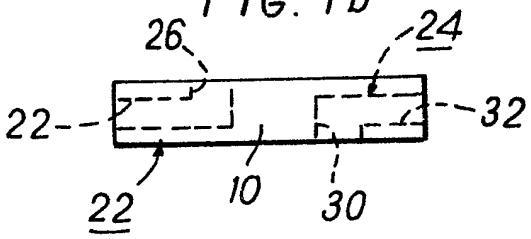


FIG. 5a

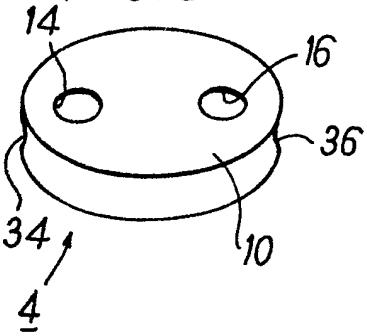
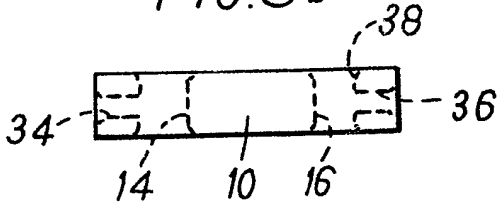


FIG. 5b



SPECIFICATION

Magnetic stirring elements

This invention relates to magnetic stirring elements for use with magnetic stirrers for mixing liquids and solutions.

Magnetic stirring apparatus is well known and commonly comprises a magnetic stirring element placed in a vessel containing the liquid to be mixed, and a drive magnet located below said vessel. On rotation of the drive magnet, said magnet couples through the base of the vessel with the stirring element causing said element to rotate and so stir the liquid.

Stirring elements commonly include bar or disc magnets encapsulated in an inert material such as plastic, but many known elements suffer from one or more of a number of disadvantages, not the least of which is that the mixing effect achieved, particularly from the cylindrical elements, can be inefficient.

It has been proposed to improve mixing efficiency by applying vanes to the outer surfaces of the disc-shaped elements. However, it will be appreciated that the presence of vanes decreases the coupling between the element and the drive magnet in that the presence of vanes on the bottom surface of the element prevents the magnet of said element approaching as close to the bottom of the vessel as would otherwise occur.

According to the present invention there is provided a stirring element for use with a magnetic stirrer, the element comprising a body portion of non-metallic material disposed in which is a permanent magnet, at least one open-ended passageway being formed in said body portion.

Preferably the body portion of the element is disc shaped with the opposed outer surfaces of said body portion being flat.

The permanent magnet may be of generally cylindrical shape with the central longitudinal axis of the magnet extending parallel with the planes of the opposed surfaces of the body portion. Conveniently the poles of the magnet are at the ends of said magnet.

In a preferred element, there are two passageways symmetrically located on either side of a magnet disposed centrally of the body portion.

In one embodiment of the invention the passageways extend axially through the body portion from one of the two opposed surfaces thereof to the other of said surfaces.

In a further embodiment of the invention, the axes of the passageways extend parallel with the longitudinal axis of the magnet.

In a still further embodiment of the invention, one passageway extends from one of the two opposed surfaces of the body portion to terminate in the curved edge of the body portion and the other passageway extends from the other of the two opposed surfaces os the body portion to terminate in said curved edge of the body portion.

Preferably the centre of gravity of the magnet substantially coincides with the centre of gravity of the stirring element.

By way of example only embodiments of the invention will now be described in greater detail with reference to the accompanying drawings of which:

Fig. 1 is a schematic view of stirring apparatus incorporating a stirring element according to the invention, and

Figs. 2*a* to 5*b* show views of four different stirring elements according to the invention.

Referring to Fig. 1 there is shown mixing apparatus comprising a vessel 2 containing liquid to be mixed and in which is located a magnetic stirring element 4. The vessel 2 is located over a drive magnet 6 rotatable about a vertical axis by means of a motor 8. On rotation of the magnet 6, the magnetic coupling between it and the magnet of the element 4 causes said element to rotate within the vessel 2 whilst hovering just above the bottom of the vessel thereby mixing the liquid. The nature and extent of the mixing is dependent upon the shape and the configuration of the element 4.

In Figs. 2*a*, 2*b* and 2*c*, which are perspective view, plan view partly in section, and vertical section respectively of a first stirring element, the element 4 is disc-shaped and comprises a body portion 10 of plastics material such as polytetrafluoroethylene moulded around a cylindrical bar magnet 12, the magnet being centrally located with the body portion and having magnetic poles at each end. A pair of passageways 14, 16 symmetrically located one to each side of the magnet 12 extend through the body portion 10 from one side to the other.

The use of such an element in the apparatus of Fig. 1 creates a large vortex in the liquid and considerable movement of liquid close to the bottom of the vessel, with liquid being forced radially of the vessel towards the centre of the vessel.

Figs. 3*a*, 3*b* and 3*c* show perspective view, plan view, and vertical section respectively of a second stirring element again comprising a body portion 10 moulded around a central bar magnet 12. Two passageways 18, 20 extend through the body portion 10, one to either side of the magnet 12, the longitudinal axes of said passageways lying parallel with the length of the magnet as best seen in Fig. 3*b*.

When used in the apparatus of Fig. 1, the stirring element of Figs. 3*a*), *3b* and 3*c* causes radial movement of liquid near the bottom of the vessel but from the centre of the vessel outwardly and doesn't result in such a large vortex in the liquid as the element of Figs. 2*a*, 2*b* and 2*c*. Thus this element would be used when vortexing is to be minimised.

The embodiments of Figs. 4 and 5 combine the mixing effects of the elements of Figs. 2 and 3. Figs. 4*a* and 4*b* are perspective view and side view respectively of an element 4 incorporating two right angled passageways 22, 24 in the body portion 10, one to each side of a central bar magnet 12. The passageway 22 includes a

vertical extent 26 from one surface of the body portion 10 to an intermediate region within said body portion, and a horizontal extent 28 from said intermediate region of the body portion to the curved outer edge of the element. The passageway 24 includes a vertical extent 30 from the other surface of the body portion 10 to an intermediate region within said body portion and a horizontal extent 32 from said intermediate region of the body portion 10 to the curved outer edge of the element, the extent 32 terminating diametrically opposite the extent 28.

Figs. 5*a* and 5*b* are perspective view and side view respectively of a fourth embodiment similar to the element of Figs. 2*a*, 2*b* and 2*c* but including a further pair of passageways 34, 36 each extending parallel with the planes of the surfaces of the element 4 and perpendicular to the length of magnet 12 and to the passageways 14, 16. The passageways 34, 36 extend from the mid-regions of the passageways 14, 16 respectively to terminate in the outer curved edge of the body portion 10.

All the above-detailed stirring elements are much quieter in use than the afore-mentioned prior art arrangements and have a tendency to hover slightly above the bottom surface of the vessel whilst allowing some mixing through the various passageways. The magnetic coupling between the element and the drive magnet 6 is at a maximum in the absence of any vanes and the like on the lower surface of the element, while the centre of gravity of the element is accordingly lower in the vessel than if vanes were present which contributes to greater stability of the element in the vessel and less tendency for the element to become uncoupled from the drive magnet and 'spin out' of its operative position. This improved coupling, together with reduced friction between the element and the liquid on rotation of said element allow for better control of the mixing speeds.

The absence of vanes reduces the possibility of the elements fouling thermometers or other probes located in the vessel.

The passageways can be utilised for purchase of the element to enable said element to be accurately positioned in and retrieved from the vessel rather than relying solely of magnetic attraction, while the symmetrical nature of the elements enables them to be located in a vessel regardless of orientation.

The mixing action of the described elements utilises a pumping action of the liquid through the passageways, the shape and location of said passageways determining the nature of the mixing action. Clearly the number, the configuration and the placement of the passageways can be chosen to suit particular requirements.

The body portions 10 of the stirring elements are conveniently of polytetratfluoroethylene in view of this materials inert chemical nature and low frictional properties.

Flow of liquid through the passageways may be improved by chamfering the ends of said passageways, as for example at 38 in Fig. 5*b*.

For laboratory use, the elements may typically be between 12 mm and 60 mm in diameter and between 5 mm and 8 mm thick, with the magnets 12 being typically between 3 mm and 6 mm in diameter and between 10 mm and 58 mm in length.

CLAIMS

1. A stirring element for use with a magnetic stirrer, the element comprising a body portion of non-magnetic material disposed in which is a permanent magnet, at least one open-ended passageway being formed in said body portion.

2. A stirring element as claimed in claim 1 in which the body portion is of generally disc shape.

3. A stirring element as claimed in claim 2 in which the opposed outer surfaces of the body portion are flat.

4. A stirring element as claimed in claim 2 or claim 3 in which the permanent magnet is of generally cylindrical shape with the central longitudinal axis of the magnet extending parallel with the planes of the opposed surfaces of the body portion.

5. A stirring element as claimed in claim 4 in which the poles of the magnet are at the ends of said magnet.

6. A stirring element as claimed in any one of claims 2 to 5 in which there are two passageways symmetrically located one either side of a magnet disposed centrally of the body portion.

7. A stirring element as claimed in claim 6 in which the passageways extend axially through the body portion from one of the two opposed surfaces thereof to the other of said surfaces.

8. A stirring element as claimed in claim 6 together with claim 3 in which the axes of the passageways extend parallel with the longitudinal axis of the magnet.

9. A stirring element as claimed in claim 6 in which one passageway extends from one of the two opposed surfaces of the body portion to terminate in the curved edge of the body portion and the other passageway extends from the other of the two opposed surfaces of the body portion to terminate in said curved edge of the body portion.

10. A stirring element as claimed in any one of claims 1 to 9 in which the centre of gravity of the magnet substantially coincides with the centre of gravity of the stirring element.

11. A stirring element as claimed in claim 7 and including two further passageways one communicating into each of said axial passageways and extending diametrically of the body portion from the centre of the associated axial passageway to terminate in the curved edge of the body portion.

12. A stirring element as claimed in any one of claims 1 to 11 in which the body portion is moulded from polytetrafluoroethylene.

13. Stirring elements substantially as described with reference to and as illustrated by the accompanying drawings.

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DERWENT-WEEK: 198401

TITLE: Laboratory magnetic stirrer element of disc shape with one or more through passages to give improved coupling with drive magnet

INVENTOR: THOMAS T R

PATENT-ASSIGNEE: THOMAS T R[THOMI]

PRIORITY-DATA: 1981GB-010659 (April 6, 1981)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE
GB 2076677 A	December 9, 1981	EN
GB 2076677 B	January 4, 1984	EN

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
GB 2076677A	N/A	1981GB-010659	April 6, 1981

INT-CL-CURRENT:

TYPE	IPC DATE
CIPS	B01F13/08 20060101

ABSTRACTED-PUB-NO: GB 2076677 A

BASIC-ABSTRACT:

Magnetic stirrer element comprises a permanent magnet located within a disc-shaped non-magnetic body. One or more passages extend through the body.

Compared with prior art vaned elements, coupling with drive magnet is improved with the lower centre of gravity providing stable operation. Control of mixing speeds is improved and operation is quiter.

Used for laboratory mixing of liquids and solns.

TITLE-TERMS: LABORATORY MAGNETIC STIR ELEMENT DISC SHAPE ONE MORE THROUGH PASSAGE IMPROVE COUPLE DRIVE MAGNET

DERWENT-CLASS: A89 J04

CPI-CODES: A04-E08; A12-E08; A12-L04; J02-A02B; J04-B;

POLYMER-MULTIPUNCH-CODES-AND-KEY-SERIALS:

Key Serials: 0210 0231 0947 2545 2706 2742

Multipunch Codes: 04- 062 064 087 476 623 627 643 688 694 726